

**UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF PUERTO RICO**

<p>In re: THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, as representative of THE COMMONWEALTH OF PUERTO RICO <i>et al.</i>, Debtors.</p> <hr/>	<p>PROMESA Title III No. 17 BK 3283-LTS</p>
<p>In re: THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, as representative of PUERTO RICO ELECTRIC POWER AUTHORITY, Debtor.</p>	<p>PROMESA Title III No. 17 BK 4780-LTS (This court filing relates only to Case No. 17 BK 4780-LTS)</p>

**ENVIRONMENTAL INTERVENORS' SUR-REPLY TO "REPLY IN FURTHER
SUPPORT OF URGENT MOTION *IN LIMINE* TO EXCLUDE TESTIMONY"**

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**ENVIRONMENTAL INTERVENORS' SUR-REPLY TO "REPLY IN FURTHER
SUPPORT OF URGENT MOTION *IN LIMINE* TO EXCLUDE TESTIMONY"**

COME NOW the Comité Diálogo Ambiental, Inc., El Puente de Williamsburg, Inc., Enlace Latino de Acción Climática, Comité Yabucoeño Pro-Calidad de Vida, Inc., Alianza Comunitaria Ambientalista del Sureste, Inc., Sierra Club Puerto Rico, Inc., Mayagüezanos por la Salud y el Ambiente, Inc., Coalición de Organizaciones Anti Incineración, Inc., and Amigos del Río Guaynabo, Inc. (the "Environmental Intervenors" or "we" or "our"), through the undersigned representative, and respectfully tender this SUR-REPLY to the REPLY (Doc. No. 1338, filed on 06/11/19) submitted by the Financial Oversight and Management Board for Puerto Rico (FOMB), in its capacity as representative of the Puerto Rico Electric Power Authority (PREPA) pursuant to Section 315(b) of PROMESA, and the Puerto Rico Fiscal Agency and Financial Advisory Authority (AAFAF) ("the Government Parties").

1. In said REPLY, the Government Parties (i) incorrectly characterize both the issues this Honorable Court must decide and the nature and scope of the expert testimony we have proffered, in order to allege that the Environmental Intervenors should be denied a voice in these proceedings; (ii) incorrectly allege that we should not be allowed to intervene; (iii) incorrectly state that the Environmental Intervenors lack Article III standing and that we have conceded that we are not "parties in interest"; and (iv) incorrectly argue that the expert witness evidence we have proffered is irrelevant to the present proceedings and, in the alternative, if it is relevant, the evidence is more prejudicial than probative. We disagree.

**A. LINK BETWEEN THE ISSUES PROPERLY BEFORE THE COURT AND THE
TRUE NATURE OF OUR PROFFERED EXPERT TESTIMONY**

2. In their REPLY, the Government Parties narrowly define the main issue of their URGENT MOTION *IN LIMINE* TO EXCLUDE TESTIMONY (Doc. No. 1300, filed on 6/7/19)

as: “[o]n the Rule 9019 Motion, the sole ‘question of law or fact’ is whether the settlement meets ‘the lowest point in the range of reasonableness’.” REPLY, pp. 2-3. The Government Parties also suggest that our proffered testimony centers on the Sun Tax, whereas “PREPA is not asking for the Court’s permission to impose the sun tax (Transition Charge); that is a decision for PREPA.” *Id.*, p. 6. Based on the thus narrowly defined scope of the 9019 hearing and the inaccurate characterization of our proffered expert testimony, the Government Parties posit that our experts’ testimony has no bearing on the 9019 hearing or these proceedings, and that intervention should therefore be denied.

3. FIRST, the Government Parties requested the 9019 hearing (Doc. No. 1235, filed 5/10/19) to obtain Court approval for the RSA, so the reasonableness and impact of every aspect of the RSA are properly before the Court. This specifically includes the Sun Tax (Transition Charge). The notion that the Government Parties are "not asking for the Court's permission to impose" the Sun Tax is inaccurate and disingenuous. That notion dismisses the Court's jurisdiction and power to examine and approve every aspect of any agreement with creditors. PREPA is asking this Court to validate the RSA. One component of the RSA, which was negotiated with and has been endorsed by some 40% percent of creditors, is the issuance of bonds secured by the imposition of a fee or charge on the amount of electricity consumed by a private customer, regardless of the source of such electricity, including, solar and other renewable or recyclable sources. These energy sources are generated through private assets of such consumer, rather than assets belonging to the debtor. Certainly, creditors may expect that they will be at least partially paid from the proceeds of the Sun Tax that they negotiated. Thus, it is appropriate to admit our expert testimony to evaluate the reasonableness of the RSA and the impact of the Sun Tax on the Environmental Intervenors and our constituencies, such as how it would affect the consumption of

energy on the island. The idea that the PREPA can impose the Sun Tax if and whenever it wants to, without legislative delegation and without this Court's prior approval, is nonsense.

4. SECOND, the 9019 hearing has been postponed, so the allegation that there is no time to consider our expert testimony for that hearing has lost all its luster and consequence. Further, the amount of time required to consider the Environmental Intervenors' testimony seems negligible compared to the long-lasting effects that the proposed RSA will cause.

5. THIRD, our proffered expert testimony is not limited to the Sun Tax. As demonstrated by our initial motion (Doc. No. 1279, filed 6/5/19), the content and graphs of section II of our MOTION FOR PERMISSIVE INTERVENTION (Doc. No. 1319), by the attached resumes of our expert witnesses (Attachments I and II), and by the partial summary of court cases and governmental administrative hearings in which the Environmental Intervenors have submitted evidence and testimony (Attachment III), the Environmental Intervenors and their experts are uniquely prepared to provide the Court with advice and information regarding a variety of important issues, including (but not limited to):

- (i) the impact of the RSA on Puerto Rico's goals for energy independence, energy affordability, and hurricane resilience (Doc. No. 1279, ¶¶ 4 and 6) codified in Law No. 17 of April 11, 2019;
- (ii) the impact of the RSA on the health of people who live near PREPA's power plants (Doc. No. 1279, ¶¶ 4 and 6);
- (iii) the effect of the Sun Tax on PREPA's efforts to install renewable energy generation into its grid (Doc. No. 1279, ¶¶ 4 and 6); including that the Sun Tax is a penalty against assets not belonging to the debtor in the sense that, according to the RSA, all those seeking to generate electricity through the purchase of private assets, will be punished with the imposition of a tax or fee, based on the kilowatt/ hour produced;
- (iv) the rates and tariffs contemplated in the RSA and their impact upon the Environmental Intervenors and their respective constituencies, and whether that settlement is reasonable in view of Puerto Rico's core environmental needs and concerns,¹ which is precisely the

¹ We note that a letter signed by several members of Congress on June 13, 2019 urges the Puerto Rican government to reject the RSA. Puerto Ricans already pay almost double the national average for electricity, and the new deal is expected to raise electric prices by about 20 percent. "Higher electricity rates are detrimental to the local economy, causing businesses to operate with reduced profit margins, leaving them less able to expand and hire new employees. The new [deal] will accelerate the outmigration of businesses and residents, depleting what is left of Puerto Rico's economic foundation," the letter said. Beyond damage to the economy, lawmakers argue the deal backtracks on a pledge to generate more of Puerto Rico's electricity through renewable sources. Attachment IV.

reason that the New Hampshire District Bankruptcy Court in the *In re Public Serv. Co.* case cited at p. 4 of the Government Parties' REPLY brief permitted the intervention of a consumer representative group which otherwise lacked full "party in interest" status and full article III standing. MOTION FOR PERMISSIVE INTERVENTION (Doc. No. 1319).

Moreover, just this past April, the Governor of Puerto Rico signed into law the "Puerto Rico Energy Public Policy Act" (Law No. 17 of April 11, 2019). Some key provisions of the Act include: transition from a centralized system based on fossil fuels to a distributed generation system based on renewable energy, designing and constructing a resilient electric system that will survive severe weather events, reach 30% energy efficiency by 2040, universal access to electric service at costs that are fair and reasonable (hopefully not surpassing 20¢ per kilowatt/hour), parameters for pricing, adjustments, escalation and profit margins for power purchase agreements. Some aspects of the RSA are inconsistent with this fundamental public policy which has been codified into law. Our experts are uniquely able to point out how the RSA undermines the law, and to provide guidance to the Court on the law and the above mentioned issues. Thus our proffered testimony is not limited to the Sun Tax or to the 9019 hearing.

B. THE ENVIRONMENTAL INTERVENORS COMPLY WITH THE CRITERIA FOR PERMISSIVE INTERVENTION

6. The Government Parties urge the Honorable Court to deny permissive intervenor status to the Environmental Intervenors because, according to them: (i) the only issue before the Court at this time is the 9019 hearing and whether the RSA meets minimal standards of reasonability (ii) allegedly, our only claimed basis for intervention is that we have a "direct stake" in the outcome of these proceedings because we are "direct consumers of electricity" and this is no basis for intervention because then everyone in Puerto Rico would qualify for intervenor status; (iii) our MOTION FOR PERMISSIVE INTERVENTION (Doc. No. 1319) shows that we only focus on the Sun Tax component of the RSA and we allegedly "do not intend to introduce testimony about the underlying claims and litigation being settled and whether that settlement is reasonable in that context," and (iv) the Environmental Intervenors, whose intervention will be in

the form of expert testimony, have not “ ‘regularly appeared’ before public utilities commissions to present [their] ‘special viewpoint.’ ”

7. In reality, we argue that intervenor status should be granted to us because we meet all the criteria for intervention. Permissive intervention under F.R.C.P. Rule 24(b)(1)(B) is available to those with “a claim or defense that shares with the main action a common question of law or fact.” Rule 2018(a) of the Federal Rules of Bankruptcy Procedure states that “[i]n a case under the Code, after hearing on such notice as the court directs and for cause shown, the court may permit **any interested entity** to intervene **generally** or with respect to **any specified matter.**” Emphasis ours. The Note to Subdivision (a) of this Rule “permits intervention of an entity not otherwise entitled to do so under the Code or this rule”. The show cause requirement may be met by rightly asserting “a sufficient stake in the outcome of the proceeding so as to require representation”, and a special expertise. Additional criteria include: whether the outcome will have a pecuniary or other negative impact on the proposed intervenor, whether intervenors’ arguments differ from those expressed by original parties, whether intervenor’s interests are already adequately represented, and whether intervention would result in undue delay or prejudice to original parties. Fed. R. Bankr. P. 2018(a).

8. The individual members of the Environmental Intervenors, *and* the constituencies which they represent, have a direct stake in the process and impact of any agreement that has been reached or will be reached with PREPA’s creditors: the payments will substantially come out of their pockets and the agreements negatively impact Puerto Rico’s economic recovery and the resources available for migrating to critically needed, legally mandated efficient renewable energy platforms. But our request for intervention is not based solely on this. **In addition** to this direct stake, the Environmental Intervenors and the proposed expert witnesses have a unique expertise

in the environmental and economic issues at play and how they interact. Specifically, our expertise includes a critical, well developed technical understanding of how the RSA subverts public policy, impedes economic recovery, and places Puerto Rico at a distinct disadvantage (section A, *supra*). The RSA should be carefully examined, since negotiated rate hikes endanger energy consumption and the stability of PREPA itself. Our clients and their experts can advise about these subjects and should be allowed to intervene.

9. It is beyond false that the Environmental Intervenors have not offered evidence in governmental and adjudicative hearings. Attachment III lists at least 38 court and administrative proceedings in which the Environmental Intervenors participated and presented evidence, much of it related to their intervention in this case. In addition, since the requested intervention comprises expert witness testimony, the attached resumés for our expert witnesses (Attachments I and II) lists over 20 cases in which they have testified, and over 40 instances in which they were consultants.

10. Moreover, we meet the remaining criteria for intervention: the RSA will have a pecuniary or other negative impact on the proposed Intervenors, Intervenors' arguments are different from those expressed by original parties, and Intervenors' position and arguments have not adequately been represented by any original party to these proceedings. We thus comply with all criteria for permissive intervention.

C. THE ENVIRONMENTAL INTERVENORS HAVE ARTICLE III STANDING

11. The Government Parties incorrectly argue at pp. 6-7 of their REPLY that we have no Article III standing, because we have allegedly not demonstrated that we have suffered or are imminently threatened with a "concrete and particularized" injury in fact. They state that this is so because we "have not alleged (and cannot allege) that the RSA's ... 'sun tax' ... violates any laws" that would allow us to seek relief, and because "the Environmental Parties ... have not identified a legal injury caused by their novel theory". *Id.* Untrue. We asserted at p. 6 of our

MOTION FOR PERMISSIVE INTERVENTION (Doc. No. 1319, filed 6/11/2019) that the Sun Tax unduly burdens all users of alternate energy sources including the Environmental Intervenors, their members, and their constituencies, and violates the environmental policies which are enshrined in Law No. 17 of April 11, 2018.

12. In any event, the Government Parties concede that complete Article III standing is not required for awarding intervenor status. They state at p. 5 of their REPLY brief that “[w]here other courts have allowed intervention in bankruptcy proceedings by **parties without standing**, they have allowed it only in limited capacities, not with the full rights granted to general intervenors under Rule 2018(a) that the Environmental Nonprofits request.” Thus, even assuming that we have no Article III standing, which we assert is untrue, this does not prevent the Court from awarding intervenor status.

D. WE DO NOT CONCEDE THAT WE ARE NOT PARTIES IN INTEREST

13. The Government Parties incorrectly allege that because in our Motion for Permission to intervene we did not extensively brief why we were “parties in interest” under 11 U.S.C. § 1109(b), we have conceded that we are not. We do not concede this point. “Party in interest” is an ill-defined term that lacks definitive interpretative jurisprudence. While there are strong reasons for why we should be granted such status, we do not have unlimited resources to research and brief every topic, and did not wish to burden this Court with arguments that are at this moment unnecessary. Permissive intervention status is better defined and achieving such status serves our present purposes, and does not require us to first establish “party in interest” status (See In re Public Serv. Co., 88 BR 546 (Bankr. D. N.H. 1988) (permitting intervention without awarding party in interest status)). We reserve the right to invest our limited resources to research, claim and prove “party in interest” status when we deem it necessary.

E. THE PROFFERED EXPERT TESTIMONY IS HIGHLY RELEVANT AND IS NOT MORE PREJUDICIAL THAN PROBATIVE

14. The U.S. Supreme Court has made clear that, before approving a compromise in a bankruptcy case, the court must apprise itself of all facts necessary to conduct “a full and fair assessment of the wisdom of the proposed compromise. See Protective Committee for Indep. Stockholders of TMT Trailer Ferry, Inc. v. Anderson, 390 U.S. 414, 424 (1968). In Anderson, the Supreme Court declared that a bankruptcy court considering a settlement must:

“apprise [itself] of all facts necessary for an intelligent and objective opinion of the probabilities of ultimate success should the claim be litigated. Further, the judge should form an educated estimate of the complexity, expense, and likely duration of such litigation, . . . and all other factors relevant to a full and fair assessment of the wisdom of the proposed compromise.”

390 U.S. 414, 424 (1968). Lower courts have followed suit. See, *e.g.*, In re Smart World Techs., LLC, 423 F.3d 166, 179 (2d Cir. 2005) (holding that 9019 settlement should not be approved without discovery and that “absence of a more fully developed record” precluded a conclusion that settlement was fair). In other words, a bankruptcy court may not merely “rubber stamp” a settlement without complete factual inquiry.

15. Notwithstanding the Supreme Court’s clear guidelines, the Government Parties again argue at p.7 of their REPLY that “the testimony that the environmental nonprofits intend to offer should be excluded as irrelevant under Rule 401 or more prejudicial or wasteful than probative under Rule 403.”

16. However, relevant evidence is evidence having **any** tendency to make the existence of **any** fact that is of consequence to the court’s understanding of the issue more or less probable than it would be without the evidence. Fed. R. Evid. 401. A principal issue in this *sui generis* case is whether the RSA reasonably compensates creditors while at the same time permitting Puerto Rico to recover economically, adopt sound environmental policies, and make the adjustments needed

to efficiently end the bankruptcy, stimulate development and prevent further harm to the environment. If approved, the RSA will restructure nearly \$9 billion in bonds, eventually lead to the transfer of \$20 billion from Puerto Rico, encumber millions of Puerto Ricans for half a century, and dictate PREPA's future plan of adjustment. It is critical to adequately weigh "all ... factors relevant to a full and fair assessment of the wisdom of the proposed compromise". Anderson, *supra*. Indeed, this special case merits close evaluation of social impact criteria.

17. As we earlier stated, our proffered expert testimony addresses the impact of the RSA on Puerto Rico's energy independence, energy affordability, hurricane resilience, and on the health of people who live near PREPA's power plants; the rates and tariffs contemplated in the RSA and their impact upon the Environmental Intervenors and their respective constituencies, and whether the RSA is reasonable in view of Puerto Rico's core health, fiscal and environmental needs and concerns.² This Court is tasked with providing oversight and guidance for a fair settlement, and should prudentially weigh the above concerns. Certainly, the proffered testimony tends to make facts which are material to the Court's task more or less probable.

18. Relevant evidence is admissible, but might be excluded if specifically prohibited by federal law, federal rule, or federal jurisprudence, which is not the case here. The Government Parties nonetheless allege at p. 9 of their REPLY that, assuming that our proffered expert testimony is relevant, it should be excluded as being more prejudicial than probative under Rule 403. They allege that they and the Court would have to invest unreasonable amounts of time and resources to depose and cross-examine witnesses, which would "add work and expense in preparation for the [9019 Hearing] and prolong the [9019 Hearing] itself by requiring unwarranted evaluation of

² Whether our proffered expert testimony may be ultimately sufficient to definitively prove any issue of consequence only goes to its weight, not to its relevance or admissibility. But, it is not possible to determine the sufficiency of the proffered evidence without first hearing it and weighing it against contrary evidence.

subsidiary issues, and would therefore run contrary to the principles of judicial economy and prudent stewardship of debtor resources.”

19. However, under Rule 403, admissible relevant evidence might be excluded only if its’ probative value is **substantially** outweighed by the danger of **unfair** prejudice, confusion of the issues, or misleading the jury, or by considerations of **undue** delay, waste of time, or needless presentation of cumulative evidence. Fed. R. Evid 403.

20. Here, a new case schedule has been proposed that essentially moots any substantial danger of undue delay, particularly for the now postponed 9019 hearing upon which the Government Parties based their opposition to intervention. This case has raged since 2017 and its impact will continue for 50 years to come. Although time and effort would be required for the presentation and proper evaluation of our expert testimony, the time required pales in comparison to the long-term damage a wrong decision would cause, and does not pose any danger of **undue** delay or **unfair** prejudice. On the contrary, the Court would greatly benefit from our expert witnesses’ special expertise, and render a more prudential decision, in keeping with Supreme Court guidelines. Excluding this evidence precludes an informed conclusion concerning the fairness, adequacy, and impact of the RSA. In re Smart World Techs., *supra*. With so much riding on this litigation there is no reason why a full factual record should not be presented to the Court.

21. The unique evidence proffered by the Environmental Intervenors is not at all cumulative, because no original party raised it. Our expert evidence will shed light on critical issues, not create confusion. Nor can it be considered a waste of time, particularly since the RSA conflicts with Puerto Rico laws and the Court’s decision will burden and affect millions of Puerto Ricans for half a century. Thus, we meet all criteria for admission of relevant evidence.

22. A new case schedule has been submitted for approval. Discovery is ongoing, and discovery motions and negotiations are pending. If intervenor status and our proffered evidence are postponed until a later date, *then* there might arise a danger of causing undue delay. **The time for receiving and scheduling the proffered relevant expert testimony and evidence is now.**

PRAYER

23. For the preceding reasons, the Environmental Intervenors respectfully request that this Honorable Court reject the Government Parties' *in limine* motion, and grant our petition for permissive intervention.

CERTIFICATION

I HEREBY CERTIFY that, on this same date, I filed this document electronically with the Clerk of Court using the CM/ECF system, which will send notification of such filing to all parties of record and CM/ECF participants in this case.

RESPECTFULLY SUBMITTED in San Juan, Puerto Rico, this 2nd day of July, 2019.

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EDUCATION

- Ph.D., Iowa State University, Ames, IA, 1996
Dissertation Title: "Risk-based operating limits for dynamic security constrained electric power systems." Advisor: Dr. James D. McCalley, committee members: Dr. V. Vittal, Dr. V. Ajjarapu, Dr. G. Sheblé, Dr. H. T. David.
- MSEE, University of Michigan, Ann Arbor, MI, 1990
- BSEE, Magna Cum Laude, University of Puerto Rico, Mayagüez, PR, 1988

POST DOCTORAL TRAINING

(9/08 - 6/09) Researcher at Plataforma Solar de Almería (PSA), Tabernas, Spain. The PSA is the premiere European research and development laboratory for solar thermal concentration systems.

Integration of standard power system models, for the electric network, generator-turbine and controls, with thermo hydraulic models of a solar thermal power plant with no energy storage to provide a comprehensive, albeit simplified, dynamic model set to simulate and study the solar power plant/electric network interaction.

ACADEMIC WORK EXPERIENCE

- (7/05 – present) Professor, (6/00 – 6/05) Associate Professor and (1/97 – 6/00) Assistant Professor of Electrical Engineering at the University of Puerto Rico, Mayagüez (UPRM).
During this time Dr. Irizarry Rivera has taught:
 1. INEL 3105 Electric Systems Analysis I
 2. INEL 4075 Electrical Engineering Fundamentals
 3. INEL 4103 Electric Systems Analysis III (Introduction to Electric Power Systems)
 4. INEL 4405 Electric Machines
 5. INEL 4407 Electrical Systems Design I
 6. INEL 4415 Electric Power Systems Analysis
 7. INEL 4048 Engineering Practice
 8. INEL 4998 Undergraduate Research
 9. INEL 5406 Transmission and Distribution Systems Design
 10. INEL 5495 Design Projects in Electric Power Systems: Design of the Distribution System for an Eolic Generation Park.
 11. INEL 5496 Design Projects in Power Electronics: Design, Simulation, Fabrication and Test of Brushless Commutation for Permanent Magnets DC Motors.
 12. INEL 5995 Special Problems - Environmental and Infrastructure Impact of Eolic Generation
 13. INEL 6025 Advanced Energy Conversion
 14. INEL 6027 Electric Power Systems Dynamics and Control
 15. INEL 6028 Optimization and Operation of Electric Power Systems
 16. INEL 6077 Over Voltage Phenomena in Electric Power Systems
 17. INEL 6995 Special Topics in Electrical Engineering: Reactive Power
 18. INEL 6995 Special Topics in Electrical Engineering: Power System Distribution

- President (1/11 – 8/12) and (08/10 – 12/10) Member, School of Engineering Personnel Committee
- President (8/06 – 06/07) and (08/09 – 08/12) Member, Electrical and Computer Engineering Department Personnel Committee
- (8/06 – 5/07) President, ADHOC Committee to Evaluate Proposals for a New UPRM Class Schedule
- (8/05 – 8/06) Elected Academic Senator UPRM.

Duties included: Coordinator of the ADHOC Committee to Design Instruments to Evaluate the Chancellors' Performance, Coordinator of the ADHOC Committee to Evaluate Proposed Academic Work Schedules for the Mayagüez Campus, Member of the Courses Committee.

- (2/00 – 8/00) Assistant Dean of Academic Affairs UPRM.

Duties included: supervisor of the Registrar Office and the Admissions Office, coordinator of the registration process for the whole Campus, author of the Academic Calendar proposal, coordinator of the Students Academic Progress Committee, supervisor of the Courses Central Archive keeper and coordinator of the Campus Early Admission Program.

- (10/00 – 01/02) and (8/99 – 2/00) Associate Director for Academic Affairs – Electrical and Computer Engineering Department, UPRM.

Duties included: Graduate Programs Director, updating the faculty recruitment plan, coordinator of the curriculum revision and accreditation processes, evaluate the creation of new academic programs, coordinator and supervisor of the Department registration process, co-author of proposals to bring external funding to the Department, in charge of promoting and facilitating scientific research in the Electrical and Computer Engineering Department.

ACADEMIC INTERESTS AT GRADUATE LEVEL:

- ✓ Renewable/alternate energy sources such as; eolic, photovoltaic and solar thermal and their integration to the grid
- ✓ Electric power system dynamics and operation
- ✓ Power systems risk assessment

EXAMPLES OF FUNDED RESEARCH and EDUCATION PROJECTS

GEARED (Grid Engineering for Accelerated Renewable Energy Deployment) – (2013) A \$929,000 project (UPRM budget out of \$6.9 million for the Consortium) to develop and run a Distributed Technology Training Consortium in the Eastern United States, led by the Electric Power Research Institute (EPRI) in collaboration with four U.S. universities (University of Puerto Rico Mayaguez, Georgia Institute of Technology, Clarkson University, University of North Carolina at Charlotte) and seventeen utilities and system operators. The Consortium will leverage utility industry R&D results with power engineering educational expertise to prepare power engineers in management and integration of renewable energy and distributed resources into the grid.

Streamlined and Standardized Permitting and Interconnection Processes for Rooftop Photovoltaic (PV) in Puerto Rico (2012) (Investigator) A \$301,911 project sponsored by the US Energy Department that seeks to improve the PV energy market of rooftop systems up to 300 kW in Puerto Rico. The project strives to create not only a standardized framework for PV deployment, but

also streamlined: organized, lean permitting and interconnection processes where most residential and small commercial PV systems can be installed safely and quickly.

Design of a Renewable Energy Track within the Electrical Engineering Program at UNAPEC, Dominican Republic (2011) A \$29,000 award to design a Renewable Energy Track within the existing Electrical Engineering Program of UNAPEC.

IGERT: Wind Energy Science, Engineering and Policy (WESEP) (2011) A \$171,600 sub-award from Iowa State University, the lead Institution, to fund master students doing research in wind technology, science, and policy as they relate to accomplishing three objectives: (a) increase the rate of wind energy growth; (b) decrease the cost of wind energy; and (c) extend penetration limits.

Center for Resources in General Education (CIVIS) – (2008) A 2,500,000 (total for UPRM), approximately \$500,000 for Engineering, education project to strengthen and further develop general education objectives at UPRM. Dr. Irizarry is the coordinator for the CIVIS supported UPRM Energy Systems Instrumentation Lab.

Achievable Renewable Energy Targets For Puerto Rico's Renewable Energy Portfolio Standard (2007) A \$327,197 project sponsored by the Puerto Rico Energy Affairs Administration (Administración de Asuntos de Energía), to produce an estimate, based in realistic boundaries and limitations, of renewable energy available in Puerto Rico for electricity production. The renewable energy resources studied were: biomass - including waste-to-energy, micro hydro, ocean - waves, tides, currents and ocean thermal, solar - photovoltaic and solar thermal, wind – utility as well as small wind, and fuel cells. The purpose of producing these estimates was to establish adequate targets, as a function of time, for Puerto Rico's Renewable Portfolio Standard.

Colegio San Ignacio - Ejemplo de Sostenibilidad (2007) A \$73,332 project to match the energy needs of Colegio San Ignacio with its available renewable energy sources. Demonstration projects with a strong educational component will be proposed to the School to be designed, installed and operated on the Scholl Campus with the participation of the School Faculty and students. The philosophy behind the program will be one of sustainable development.

Programa Panamericano de Capacitación en Ingeniería de Potencia Eléctrica (2006) A \$97,370 educational project to deliver a Web-broadcast master program in electric power engineering to engineers at UNAPEC University in the Dominican Republic. Courses in this program responded to the reality and necessities of the Dominican Republic electric power industry and aims for sustainable development.

Caguas Sustainable Energy Showcase, Phase I (2006) A \$90,055 project sponsored by the Municipality of Caguas, Puerto Rico to assess the current electric energy consumption profile, by sector; residential, commercial, industrial and governmental, of Caguas and to propose achievable goals (percentages of demand), by sector, to be satisfied using renewable energy sources.

Failure Probabilities for Risk-Based Maintenance and Parameter Estimation of Synchronous Machines (2003) A \$99,444 project sponsored by the National Science Foundation (NSF) to estimate parameters and failure probabilities for synchronous generators. The main outcomes of this work were the application of useful alternate robust estimation techniques and the identification of failure modes for risk-based maintenance of generators.

Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks (2002) A \$499,849 project sponsored by the National Science Foundation (NSF) and the Office for Naval Research (ONR) to develop a model for the next generation power network using a distributed concept based on scalable coordination by an *Intelligent Power Router* (IPR). Our goal

was to show that by distributing network intelligence and control functions using the IPR, we will be capable of achieving improved survivability, security, reliability, and re-configurability. Our approach builds on our knowledge from power engineering, systems, control, distributed computing, and computer networks.

Puerto Rico Wind Resource Assessment - Phase I: Partnership formation and prospective site identification (2002) A \$32,465 project sponsored by the Puerto Rico Energy Affairs Administration to increase the knowledge of wind resources in Puerto Rico. We assessed wind velocity probabilities at sites that may be used to install wind farms. The criteria to select the prospective sites was not convenience of data gathering, such as existing towers or existing wind recording stations, but land availability for establishment of a wind farm, road access, available electric grid connections, zoning regulations and indicators of potential wind resource such as existing wind data, topography, wind-deformed vegetation or eolian landforms.

Puerto Rico SMES Project Phase I - Evaluation Study (1997-99) A \$579,188 project sponsored by FOMENTO's Science and Technology Board to determine the energy requirements (size) of an energy storage unit to provide Puerto Rico's electrical system with rapid response spinning reserve in order to prevent blackouts under generation deficiency conditions.

EXAMPLES OF FUNDED TECHNOLOGY TRANSFER PROJECTS

Wind Resource Assessment in Caguas (2010) A technology transfer project, derived from **Caguas Sustainable Energy Showcase, Phase I** (see below).

Inspección de Instalación de Calentadores de Agua Solares y Generación Fotovoltaica Suplementaria para la Urbanización Villa Turabo en Caguas (2010) A technology transfer project, derived from **Caguas Sustainable Energy Showcase, Phase I** (see below).

Sustainable Energy Projects for Bayamón's Sustainability Master Plan (2009) A technology transfer project. Duties included: assist Bayamón's staff to define the scope of renewable energy projects. Pre-design a Photovoltaic Parking Roof for the Sports Complex Onofre Carballeira Umpierre, write the RFP sent to companies, evaluate the design submitted by companies that responded to the RFP, design performance criteria for the construction, test, and delivery phases of the project and evaluate the performance of the company/companies during the construction, test, and delivery phases of the project.

Ahorro Energético vía Calentadores de Agua Solares y Generación Fotovoltaica Suplementaria para la Urbanización Villa Turabo en Caguas (2007) A \$37,800 technology transfer project, derived from **Caguas Sustainable Energy Showcase, Phase I** (see below), to produce an estimated 25% energy savings in 100 residences at Villa Turabo, Caguas via solar thermal water heaters and supplemental photovoltaic electricity generation.

INTERNATIONAL CONFERENCES AND WORKSHOPS COORDINATION

1. (06/06 – 06/10) Member of the Probabilistic Methods Applied to Power Systems International Society (PMAPS IS) The PMAPS IS, incorporated in Canada, is the governing body of the PMAPS Conferences. From 06/06 thru 05/08 Dr. Irizarry Rivera was the General Chair of the coming PMAPS 2008 Conference and his primary responsibility was to organize the PMAPS 2008 Conference. From 05/08 thru 06/10 Dr. Irizarry Rivera is the General Chair of the previous PMAPS Conference and his primary responsibility is to manage the selection of a venue for PMAPS 2012.
2. (06/06 – 05/08) General Chair of the 10th International Conference on Probabilistic Methods Applied to Power Systems (PMAPS 2008) Rincón, Puerto Rico, May 25-29, 2008. The PMAPS Conferences fill a

needed role in the power engineering community by providing a regular forum for engineers and scientists worldwide to interact around the common theme of power engineering decision problems under uncertainty.

3. (01/06 – 05/06) Chair of the Sustainable Energy Workshop “**De Acuerdo con la Energía Sostenible y Ahora ¿Cómo llegar allí?**” at the University of Puerto Rico Mayagüez, May 22 and 23, 2007.

OTHER RECENT PROFESSIONAL EXPERIENCE

ELECTRIC POWER INDUSTRY

(06/12 – 09/14) Member of the Board of Directors - Puerto Rico Electric Power Authority (PREPA).
Elected Member Representing the Interest of Consumers.

- Vice-President of the Board
- President, Board Committee for Audits
- Member, Board Committee on Electric Power System State and Improvements
- Member, Board Committee on Labor and Legal Affairs
- Member, Board Committee on Customer Services

EXPERT WITNESS IN CIVIL COURT

1. (03/11 – 06/12) Expert witness – Case Number: Pending, Family of Félix López Orjales vs. Puerto Rico Electric Power Authority et al.
2. (02/10 – 06/12) Expert witness - A DP 2007-0085 Héctor Soto Villanueva et al. vs. Puerto Rico Electric Power Authority et al. - Aguadilla Court House, Aguadilla, Puerto Rico.
3. (07/09 – 06/12) Expert witness – Civil case number 09-cv-01340 (SEC) Leticia Figueroa Villegas et al. vs. Autoridad de Energía Eléctrica et al. United States District Court for the District of Puerto Rico, San Juan, Puerto Rico.
4. (07/09 – 06/12) Expert witness – Civil case number EDP 2009-0097 (402) Luz Eneida Marcano Díaz et al. vs. Autoridad de Energía Eléctrica et al. Caguas Court House, Caguas, Puerto Rico.
5. (07/09 – 06/12) Expert witness – Civil case number EDP 2009-0022 Eduardo Nieves et al. vs. Autoridad de Energía Eléctrica et al. Caguas Court House, Caguas, Puerto Rico.
6. (05/07 – 06/12) Expert witness – Civil case number ADP 2003-0130 José A. Rosario Cordero vs. Municipio de Aguadilla, et al. Aguadilla Court House, Aguadilla, Puerto Rico.
7. (08/05 – 06/12) Expert witness – Civil case number A BCI2006-0085 Fabián Crespo Muñiz et al. vs. Autoridad de Energía Eléctrica et al. Aguada Court House, Aguadilla, Puerto Rico.
8. (07/09 – 04/11) Expert witness - Civil case number 09-cv-1844 (CCC) Francisco Antonio Frías Pujols et al. vs. Puerto Rico Electric Power Authority - United States District Court for the District of Puerto Rico San Juan, Puerto Rico
9. (06/07 – 06/08) Expert witness – Civil case number ISCI 2006-00937 (206) Emilio Malavé Ortiz y Enid Rivera Román vs. Autoridad de Energía Eléctrica Mayagüez Court House, Mayagüez, Puerto Rico.

10. (09/05 – 05/08) Expert witness – Civil case number I DP2002-0257 Marilyn Meléndez Vélez et al. vs. Autoridad de Energía Eléctrica et al. Mayagüez Court House, Mayagüez, Puerto Rico.
11. (10/04 – 06/12) Expert witness – Civil case number DKPD-2002-0610 (1008) Naomi Malavé Conde, et al. vs. Distribuidora de Provisiones y Comestibles, Inc., Bayamón Court House, Bayamón, Puerto Rico.
12. (12/02 – 06/12) Expert witness – Civil case number DKDP2002-0460 (1008) Dalia E. Rivera Ortiz, et al. vs. Autoridad de Energía Eléctrica. Bayamón Court House, San Juan, Puerto Rico.
13. (06/01 – 06/12) Expert witness – Civil case number K DP2002- 0108 (503) Maribel Lozada Rodríguez vs. Autoridad de Energía Eléctrica. San Juan Court House, San Juan, Puerto Rico.
14. (11/03 – 11/07) Expert witness – Civil case number DKDP2003-578 (1001) Francisco Colón Calcador vs. Autoridad de Energía Eléctrica. Bayamón Court House, San Juan, Puerto Rico.
15. (06/02 – 01/04) Expert witness – Civil case number K DP2002-1088 María Jiménez Carrión vs. Municipio de San Juan. San Juan Court House, San Juan, Puerto Rico.
16. (2/01 – 02/03) Expert witness – Civil case number E DP1997-0275 (402) Gerardo Pérez Viera vs. Autoridad de Energía Eléctrica y otros. Caguas Court House, Caguas, Puerto Rico.
17. (7/00 – 1/02) Expert witness – Civil case number F DP1999-0011, Pablo Sánchez Rosa y otros vs. Cooperativa de Seguros Múltiples y otros. Carolina Court House, Carolina, Puerto Rico.
18. (5/98 – 10/98) Expert witness - Civil Case number K DP1995-0084, María Elena Ravelo Egaña vs. Autoridad de Energía Eléctrica. San Juan Court House, San Juan, Puerto Rico.

ELECTRIC POWER GRID MANAGEMENT EVALUATION

- (05/07 – 06/09) Consultant – Engineering evaluation of power system transmission and distribution limitations for Cunningham Lindsey International, Inc. provided technical advice associated to a claim of increased operational costs due to restrictions on a power system operation.

RENEWABLE ENERGY

1. (01/11 – 05/12) Consultant - Wind Energy Resource Assessment for New Era Eolic LLC, Puerto Rico.
2. (07/10 – 08/11) Consultant – Engineering supervision of residential photovoltaic installations in Urbanización Villa Turabo, Municipio Autónomo de Caguas.
3. (07/09 – 08/10) Consultant - Engineering services (assist in the definition of the project, pre-design, drafting of “Request for Proposals”, evaluation of proposals and definition of performance criteria) in a 250 kW photovoltaic project on the Onofre Carballeira Sports Complex, Municipio Autónomo de Bayamón.
4. (08/07 – 08/08) Consultant – Engineering design of residential photovoltaic generation for one hundred (100) dwellings in Urbanización Villa Turabo, Municipio Autónomo de Caguas.
5. (10/06 – 12/06) Consultant – Provided technical advice in sitting and interconnection issues for potential wind energy projects for UPC Wind.
6. (06/04 – 06/05) Consultant to, and Partner of, ecoEnergy - Provided engineering services and technical advice in wind data analysis, sitting, preliminary wind turbines selection, interconnection

issues and preliminary power purchase agreement negotiations for potential wind energy projects in Puerto Rico.

7. (4/01 – 07/02) Consultant – Provided engineering services and technical advice in wind data analysis, sitting, preliminary wind turbines selection, interconnection issues with a proposed desalination plant and drafting of "Request for Information" and "Request for Proposals" documents for the Puerto Rico Energy Affairs Administration.

PEER REVIEWED PUBLICATIONS:

1. Agustín A. Irizarry-Rivera, Efraín O'Neill-Carrillo and E. Jiménez-Toribio, "Puerto Rico Small Hydro Report", Status of the Caribbean Chapter on World Small Hydropower Report, International Network for Small Hydropower, Lara Jin Qiu-ting Esser (Editor), 2014.
2. Agustín A. Irizarry-Rivera, Manuel Rodríguez-Martínez, Bienvenido Vélez, Miguel Vélez-Reyes, Alberto R. Ramirez-Orquin, Efraín O'Neill-Carrillo and José R. Cedeño, "Chapter 3 Intelligent Power Routers: Distributed Coordination for Electric Energy Processing Networks", In J. Momoh, L. Mili (Editors) *Operation and Control of Electric Energy Processing Networks*, John Wiley and Sons/IEEE Press, 2010.
3. José A. Colucci Ríos, Efraín O'Neill-Carrillo and Agustín A. Irizarry-Rivera. "Renewable Energy in the Caribbean: A Case Study from Puerto Rico", In E. Laboy, F. Schaffner, A. Abdelhadi (Editors) *Environmental Management, Sustainable Development and Human Health*, Taylor and Francis Press, 2009, pp 291.
4. Efraín O'Neill-Carrillo, Marla Pérez-Lugo, Cecilio Ortiz-García, Agustín A. Irizarry-Rivera and José A. Colucci-Ríos, "Sustainable Energy: Balancing the Economic, Environmental and Social Dimensions of Energy," Proceedings of the IEEE Energy 2030 Conference, November 2008, Atlanta, Georgia.
5. Efraín O'Neill-Carrillo, Agustín A. Irizarry-Rivera, José A. Colucci-Ríos, William Frey, Cecilio Ortiz-García and Marla Pérez-Lugo, "Advancing a Sustainable Energy Ethic Through Stakeholder Engagement," Proceedings of the IEEE Energy 2030 Conference, November 2008, Atlanta, Georgia.
6. Efraín O'Neill-Carrillo, Marla Pérez-Lugo, Cecilio Ortiz-García, Agustín A. Irizarry-Rivera and José A. Colucci-Ríos, "Sustainability, Energy Policy and Ethics in Puerto Rico", Proceedings of Energy and Responsibility: A Conference on Ethics and the Environment, April 10-12, 2008, Knoxville, Tennessee.
7. José A. Colucci Ríos, Agustín A. Irizarry-Rivera and Efraín O'Neill-Carrillo, "Sustainable Energy for Puerto Rico", Proceedings of the 2007 Energy Sustainability Conference, June 27-30, 2007, Hilton Long Beach, California, USA.
8. Agustín A. Irizarry-Rivera, Manuel Rodríguez-Martínez, Bienvenido Vélez, Miguel Vélez-Reyes, Alberto R. Ramirez-Orquin, Efraín O'Neill-Carrillo and José R. Cedeño, "Intelligent Power Routers: A Distributed Coordination Approach for Electric Energy Processing Networks", International Journal of Critical Infrastructures, Vol. 3 No 1/2 pp. 20-57, 2007.
9. Efraín O'Neill-Carrillo and Agustín A. Irizarry-Rivera, "Socially-Relevant Capstone Design Projects in Power Engineering," Proceedings of the IEEE/PES Power Systems Conference and Exposition, October 2006, Atlanta, GA.
10. Luis O. Jimenez, Efraín O'Neill, William Frey, Rafael Rodríguez-Solis, Agustín A. Irizarry-Rivera, and Shawn Hunt, "A Learning Module of Social and Ethical Implications for Electrical and Computer

Engineering Capstone Design Courses", Proceedings of the Thirty-sixth Annual Frontiers in Education Conference, San Diego, California, October 28-31, 2006.

11. Efraín O'Neill-Carrillo, Eddie Marrero, Agustín A. Irizarry-Rivera, "Integrated Laboratory Experiences in Power Engineering Courses," Proceedings of the International Conference on Engineering Education, July 2006, San Juan, Puerto Rico.
12. Efraín O'Neill-Carrillo, Agustín A. Irizarry-Rivera, Jorge A. Cruz-Emeric, "Curricular Revisions in Electrical Engineering at UPRM," Proceedings of the Thirty-fifth Annual Frontiers in Education Conference, Indianapolis, Indiana, October 2005.
13. Carlos A. Ramos-Robles and Agustín A. Irizarry-Rivera, "Economical Effects of the Weibull Parameter Estimation on Wind Energy Projects", Proceedings of the Thirty-seventh Annual North American Power Symposium, Ames, Iowa, October 23-25, 2005.
14. Linda Monge-Guerrero and Agustín A. Irizarry-Rivera, "A Degradation Model of Synchronous Generator Stator Insulation to Compute Failure Probabilities", Proceedings of the Thirty-seventh Annual North American Power Symposium, Ames, Iowa, October 23-25, 2005.
15. Jennifer Jiménez-González and Agustín A. Irizarry-Rivera, "Generation Displacement, Power Losses and Emissions Reduction due to Solar Thermal Water Heaters", Proceedings of the Thirty-seventh Annual North American Power Symposium, Ames, Iowa, October 23-25, 2005.
16. Héctor R. Zamot, Efraín O'Neill-Carrillo and Agustín A. Irizarry-Rivera, "Analysis of Wind Projects Considering Public Perception and Environmental Impact," Proceedings of the Thirty-seventh Annual North American Power Symposium, Ames, Iowa, October 23-25, 2005.
17. Carlos A. Ramos-Robles and Agustín A. Irizarry-Rivera, "Development of Eolic Generation Under Economic Uncertainty", Proceedings of the Eighth Probabilistic Methods Applied to Power Systems (PMAPS) International Conference, Ames, Iowa, September 13-16, 2004.
18. Carlos M. Torres-Ortolaza and Agustín A. Irizarry-Rivera, "Failure Modes and Failure Probability of Intelligent Power Routers", Proceedings of the Eighth Probabilistic Methods Applied to Power Systems (PMAPS) International Conference, Ames, Iowa, September 13-16, 2004.
19. Agustín A. Irizarry-Rivera, Manuel Rodríguez, Miguel Vélez-Reyes, José R. Cedeño, Bienvenido Vélez Efraín O'Neill-Carrillo and Alberto Ramírez, "Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks", Proceedings of the 2003 EPNES Workshop, Orlando, Florida, October 23-24, 2003.
20. Tania Martínez-Navedo and Agustín A. Irizarry-Rivera, "Voltage Stability Assessment of an Island's Power System as a Function of Load Model", Proceedings of the Thirty-fifth Annual North American Power Symposium, University of Missouri-Rolla, Rolla, Missouri, October 20-21, 2003.
21. Agustín A. Irizarry-Rivera. "Benefits of Storing Electric Energy from Wind in Puerto Rico", Proceedings of the Caribbean Colloquium on Power Quality (CCPQ), Dorado, Puerto Rico, June 24-27, 2003.
22. Efraín O'Neill Carrillo, Miguel Vélez Reyes, Agustín A. Irizarry-Rivera and Eduardo Marrero. "The Power of Undergraduate Research", IEEE Power and Energy Magazine, Volume 1, Number 4, July/August 2003.

23. Agustín A. Irizarry-Rivera and J.D. McCalley. "Risk of Insecurity", Proceedings of the Euro Conference on Risk Management in Power System Planning and Operation in a Market Environment (RIMAPS 2001), Porto, Portugal, September 8-11, 2001.
24. Efraín O'Neill Carrillo, Agustín A. Irizarry-Rivera and Miguel Vélez Reyes. "Curriculum Improvements in Power Engineering", Proceedings of the Thirty-first ASEE/IEEE Frontiers in Education Conference, Reno, Nevada, October 10-13, 2001.
25. A.A. Irizarry-Rivera, Wenceslao Torres and Efran Paredes. "Evaluation and Technology Review of Energy Storage for the PREPA System", Proceedings of the Electric Energy Storage Applications and Technologies Conference, Orlando, Florida, September 18-20, 2000.
26. A.A Irizarry-Rivera. "Teaching Electric Power System Analysis Using Visually Attractive Tools," Proceedings of the Twenty-ninth ASEE/IEEE Frontiers in Education Conference, San Juan, Puerto Rico November 10-13, 1999.
27. A.A Irizarry-Rivera, Manuel A. Pérez Quiñonez and Rudolph P. Darken. "Using Virtual Worlds to Explore Electric Power Grids and Plants," Proceedings of the Twenty-ninth ASEE/IEEE Frontiers in Education Conference, San Juan, Puerto Rico November 10-13, 1999.
28. L.C. González-Carrasquillo and A.A. Irizarry-Rivera. "Calculation of Capacity Value of a Wind Farm in Puerto Rico's Electric Power System," Proceedings of the Sustainable Applications for Tropical Island States (SATIS '99) Conference, San Juan, Puerto Rico, August 25-27, 1999.
29. A.A. Irizarry-Rivera and Ivette Malpica Crespo. "Monolineal Animado y Equivalente del Sistema Eléctrico Existente en Puerto Rico: Una Herramienta de Enseñanza," Memorias del IX Simposio de Ingeniería Eléctrica, Universidad Central de las Villas, Santa Clara, Cuba, February 24-27, 1999.
30. E. Paredes-Maisonet and A.A Irizarry-Rivera. "Energy Storage Systems to Mitigate Frequency Decline under Generation Deficiency Conditions," Proceedings of the Thirtieth Annual North American Power Symposium, Cleveland State University, Cleveland, Ohio, 1998.
31. M. Rodríguez-Fernández and A.A Irizarry-Rivera. "Overview of the Dynamic Performance of a Small Electric Power System in the Presence of Eolic Generation," Proceedings of the Thirtieth Annual North American Power Symposium, Cleveland State University, Cleveland, Ohio, 1998.
32. Jiménez-Dávila and A.A Irizarry-Rivera. "Establishment of a Lightning Location System in Puerto Rico," Proceedings of the Thirtieth Annual North American Power Symposium, Cleveland State University, Cleveland, Ohio, 1998.
33. L.C. González-Carrasquillo and A.A Irizarry-Rivera. "A Procedure to Determine Wind Power Capacity Value and its Future Application to Puerto Rico's Electric Power System," Proceedings of the Thirtieth Annual North American Power Symposium, Cleveland State University, Cleveland, Ohio, 1998.
34. J.D. McCalley, A.A. Fouad, V. Vittal, A.A. Irizarry-Rivera, B.J. Agrawal and R.G. Farmer. "A Risk-Based Security Index for Determining Operating Limits in Stability Limited Electric Power Systems," IEEE Transactions on Power Systems, Volume 12 , Issue 3 , Aug. 1997, pp. 1210-1219.
35. A.A. Irizarry-Rivera, J.D. McCalley and Vijay Vittal. "Computing Probability of Instability for Stability Constrained Electric Power Systems," Electric Power Systems Research Journal, Volume 42, Issue 2, August 1997, pp. 135-143.

36. A.A. Irizarry-Rivera, J.D. McCalley and V. Vittal. "Limiting Operating Point Functions and their Influence on Probability of Instability," Proceedings of the Fifth Probabilistic Methods Applied to Power Systems (PMAPS) International Conference, Vancouver, British Columbia, Canada, September, 1997.
37. Z. Zhu, S. Zhao, J.D. McCalley, V. Vittal and A.A. Irizarry-Rivera. "Risk-Based Security Assessment Influenced by Generator Rejection," Proceedings of the Fifth Probabilistic Methods Applied to Power Systems (PMAPS) International Conference, Vancouver, British Columbia, Canada, September, 1997.
38. Nguyen, A.A. Irizarry-Rivera, J.D. McCalley and V. Vittal. "Survey Development for Assessing Impact of Power System Disturbances," Proceedings of the Fifth Annual Midwest Electro-Technology Conference, Iowa State University, Ames, Iowa, 1996.
39. A.A. Irizarry-Rivera and J.D. McCalley. "A Cartesian Product Approach to Determine the Probability of Instability for Stability Limited Electric Power Systems," Proceedings of the Twenty-seventh Annual North American Power Symposium, Montana State University, Bozeman, Montana, 1995.
40. A.A. Irizarry-Rivera, J.D. McCalley, V. Vittal, and A.A. Fouad. "A Risk-Based Electric Power System Security Index: Moving from Frequency to Probability of Instability," Proceedings of the Fourth Annual Midwest Electro-Technology Conference, Iowa State University, Ames, Iowa, 1995.
41. A.A. Irizarry-Rivera and J.D. McCalley. "A Security Assessment Approach for Stability-limited Electric Power Systems Using a Risk-based Index," Proceedings of the Thirty-second Annual Power Affiliate Meeting, Iowa State University, Ames, Iowa, 1995.
42. J.D. McCalley, A.A. Fouad, V. Vittal, A.A. Irizarry-Rivera, B.J. Agrawal and R.G. Farmer. "A Probabilistic Problem in Electric Power System Operation: The Economy-Security Tradeoff for Stability Limited Power Systems," an invited paper, Proceedings of the Third International Workshop on Rough Sets and Soft Computing, San Jose State University, San Jose, California, 1994.

SELECTED PRESENTATIONS:

1. Armando Figueroa, A.A. Irizarry-Rivera. "Requisitos de Reserva Operacional de un Sistema de Potencia Eléctrica con Significativa Generación Renovable", Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), Viernes 360-Centro de Convenciones, San Juan, Puerto Rico, May 16, 2013.
2. A.A. Irizarry-Rivera, E. O'Neill-Carillo. "Streamlined and Standardized Permitting and Interconnection Processes for Rooftop Photovoltaic Systems in Puerto Rico", Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), Casa Capitular Calle Obispado, Mayagüez, Puerto Rico, May 14, 2013.
3. A.A. Irizarry-Rivera. "¿Cuál Crisis Energética? El uso racional de la energía y renovables", Convención de la Sociedad de Planificadores de Puerto Rico, Sede del Colegio de Arquitectos y Arquitectos Paisajistas, Calle del Parque 255, San Juan, Puerto Rico, November 14, 2012.
4. A.A. Irizarry-Rivera. "Generación Eólica: El Debate de Comida vs. Energía", Escuela de Leyes, Pontificia Universidad Católica de Ponce, March 20, 2012.
5. A.A. Irizarry-Rivera. "Concentrated Solar Thermal Electricity Production: Principles, Resource and Technology", Brickell Avenue Business Interruption and Energy Conference (BABIEC), JW Marriot, Miami, October 27-28, 2011.

6. A.A. Irizarry-Rivera. "Wave to Wire: An Overview of Electricity Generation from Waves; Resource, Technology, System Integration and Economics", New York Power Conference, Downtown Conference Center at Pace University, Manhattan, New York City, New York, May 19, 2011.
7. A.A. Irizarry-Rivera. "The estate vs. the citizens: Crisis (mis)management in education and energy", Lucidity and Engagement: The UPR Strikes (2010-2011) and Academic Activism in Puerto Rico (Part 2), A panel session in the American Ethnological Society (AES) and the Society for Urban, National and Transnational Anthropology (SUNTA) Meeting, Caribe Hilton Hotel, San Juan, Puerto Rico, April 15, 2011.
8. A.A. Irizarry-Rivera. "Recurso Solar en Puerto Rico y la Tecnología Solar Térmica para la Producción de Electricidad", Universidad Interamericana Recinto de Guayama, April 8, 2011.
9. A.A. Irizarry-Rivera. "A usar el español en la investigación tecnológica: reflexión de un ingeniero a su regreso de Andalucía", Universidad de Puerto Rico, Mayagüez, October 12, 2010.
10. A.A. Irizarry-Rivera. "Achievable Renewable Energy Targets for Puerto Rico", Universidad Interamericana Recinto de Guayama, April 15, 2010.
11. A.A. Irizarry-Rivera. "Renewable Portfolio Standards", Convención Anual Colegio de Químicos de Puerto Rico 2007, Puerto Rico Conventions Center, August 10, 2007.
12. A.A. Irizarry-Rivera. "Alternativas Energéticas Sostenibles. Energía Solar: Termal y Fotovoltaica", Convención Anual Colegio de Ingenieros y Agrimensores de Puerto Rico 2007, Cambio Climático: Ingeniería, Agrimensura y Sostenibilidad, Hotel El Conquistador, Fajardo, Puerto Rico, August 3, 2007.
13. A.A. Irizarry-Rivera. "Energía Eólica, Conservación y el Ejemplo de Caguas", Noveno Congreso de Investigación y Creación Académica de la Universidad de Puerto Rico en Ponce, Teatro General UPR – Ponce, May 11, 2007.
14. A.A. Irizarry-Rivera. "Energía Eólica", Mega Viernes Civil, Seminario de Diseño y Construcción Verde del Instituto de Ingenieros Civiles, Colegio de Ingenieros y Agrimensores de Puerto Rico, Centro de Convenciones de Puerto Rico, May 18, 2007.
15. A.A. Irizarry-Rivera. "Generación Eólica y Solar: Fotovoltaica, Termal", Tercera Reflexión Ambiental, Foro de Desarrollo de Energía Sustentable, Teatro de la Universidad de Puerto Rico, Río Piedras, April 18, 2007.
16. A.A. Irizarry-Rivera & Gerson Beauchamp "Generación Fotovoltaica para Puerto Rico", Workshop sponsored by the Alianza Ciudadana para Educación en Energía Renovable (ACEER), Centro Cultural de Mayagüez, April 21, 2007.
17. A.A. Irizarry-Rivera. "Costo de la generación eólica y ahorro por desplazamiento de generación", Conference sponsored by the Puerto Rico Chamber of Commerce, Hotel Condado Plaza, San Juan Puerto Rico, February 21, 2007.
18. A.A. Irizarry-Rivera. "Energía eléctrica en Puerto Rico: generación, transmisión y conservación", Workshop sponsored by the Alianza Ciudadana para la Educación en Energía Renovable (ACEER), Centro Cultural de Mayagüez, February 3, 2007.

19. A.A. Irizarry-Rivera and E. Juan-García "Electrical Shock and Trauma: Causes, Mechanisms of Injury and Case Studies", Workshop sponsored by the Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), CIAPR Mayagüez, November 8, 2005.
20. A.A. Irizarry-Rivera. "Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks: Second Year Progress Report", Electric Power Networks Efficiency and Security (EPNES) Workshop, sponsored by the National Science Foundation (NSF), Mayagüez, Puerto Rico, July 12-14, 2004.
21. A.A. Irizarry-Rivera. "Environmental Impact of Eolic Power", Sustainable Energy Workshop sponsored by the Instituto de Ingenieros Electricistas del Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), CIAPR Headquarters, May 19, 2004.
22. A.A. Irizarry-Rivera. "Electricity Hazards", Energy Systems Seminal Series (ES³) Electrical and Computer Engineering Department, University of Puerto Rico, Mayagüez, March 30, 2004.
23. A.A. Irizarry-Rivera, M. Vélez Reytez and E. O'Neill-Carrillo. "Risk-Based Maintenance and Parameter Estimation of Synchronous Machines", Power System Engineering Research Center (PSERC) Industrial Advisory Board Meeting, December 10-12, 2003.
24. A.A. Irizarry-Rivera. "Future Power Systems", Industry University Symposium on Electrical Engineering, sponsored by the Instituto de Ingenieros Electricistas del Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), CIAPR Headquarters, November 14, 2003.
25. A.A. Irizarry-Rivera. "Electric Power from the Wind", Energy Systems Seminal Series (ES³) Electrical and Computer Engineering Department, University of Puerto Rico, Mayagüez, October 30, 2003.
26. A.A. Irizarry-Rivera. "Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks: First Year Progress Report", Electric Power Networks Efficiency and Security (EPNES) Workshop, sponsored by the National Science Foundation (NSF), Orlando, Florida, October 23-24, 2003.
27. A.A. Irizarry-Rivera. "Eolic Generation", Energy Forum sponsored by the Colegio de Ingenieros y Agrimensores de Puerto Rico (CIAPR), Hotel Wyndham El Conquistador, August 1st, 2003.
28. A.A. Irizarry-Rivera. "EPNES: Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks", Modernizing the National Grid Workshop, sponsored by the National Science Foundation (NSF), New Orleans, Louisiana, November 18-19, 2002.
29. A.A. Irizarry-Rivera. "Puerto Rico SMES Project", Puerto Rico Chamber of Commerce and Guests, Puerto Rico Chamber of Commerce Headquarters, Old San Juan, Puerto Rico, January 28, 1998.

GRADUATE THESES and PROJECTS SUPERVISED:

1. Carlos García. "Ocean Wave Energy into Electricity Using Point Absorbers (Wave Energy) in the North Coast of Puerto Rico", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, In progress.
2. Luis de Jesús. "Design and Characterization of Fresnel Solar Concentrator for Solar Thermal Drying of Coffee in Puerto Rico", ME Report, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2014.

3. Armando Figueroa. "Requisitos de Reserva Operacional de un Sistema de Potencia Eléctrica con Significativa Generación Renovable", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2013.
4. Felipe Hernández. "Feasibility of Dish/Stirling Solar Thermal Generation in Puerto Rico and in the Dominican Republic", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2012.
5. Franchesca Aponte. "Ocean Wave Energy into Electricity Using Offshore Wave Energy Devices in the North Coast of Puerto Rico", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2009.
6. Magaby Quintero. "Ocean Wave Energy into Electricity Using Shoreline Devices in Puerto Rico", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2009.
7. Miguel Rios. "Small Wind / Photovoltaic Hybrid Renewable Energy System Optimization", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2008.
8. Linda Monge. "Effect of Distributed Energy Storage Systems in Voltage Stability of an Island Power System", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2006.
9. Jennifer Jiménez. "Benefits of Electric Generation Displacement Using Solar Thermal Water Heating", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2005.
10. Carlos Ramos. "Determination of Favorable Conditions for the Development of a Wind Power Farm in Puerto Rico", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2005.
11. Carlos Torres. "Failure Probability of Intelligent Power Routers", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2005.
12. Orlando Leal Flores. "Analysis and Simulation of EM Fields of a Permanent Magnets DC Linear Motor used to Propel a Magnetically Levitated Train", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2004.
13. Tania Martínez Navedo. "Voltage Stability Assessment of an Island Power System as a Function of Load Model", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2002.
14. Jorge Valenzuela Valenzuela. "Development of Small Signal Analysis Tools to Study Power System Dynamics Using Simulink", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2001.
15. Ismael A. Jiménez Dávila. "Calibration of Magnetic Finder System for Lightning Location Using AM Carrier Signals", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2000.
16. Francisco Quiles Torres. "Identifying Electrical Needs and Implementing Improvements on the Main Power Substation of a Manufacturing Plant", ME Project, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2000.
17. Luis C. González Carrasquillo. "A Procedure to Determine Wind Power Capacity Value and its Future Application to Puerto Rico's Electric Power System", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 2000.

18. Efran Paredes Maisonet. "Determination of Required Rapid Response Spinning Reserve to Avoid Under frequency Load Shedding under Generation Deficiency Conditions in Puerto Rico's Electric Power System", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 1999.
19. Mireya Rodríguez Fernández. "Power System Dynamic Analysis for the Integration of Wind Farms to Puerto Rico's Electric Grid", MS Thesis, University of Puerto Rico-Mayagüez, Mayagüez, Puerto Rico, 1999.

HONORS AND OTHER PROFESSIONAL ACTIVITIES:

- Recipient "Ingeniero Electricista Distinguido 2013" (Distinguished Electrical Engineer 2013) from the Mayagüez Chapter of the Puerto Rico Professional Engineers Society (Capítulo de Mayagüez del Colegio de Ingenieros y Agrimensores de Puerto Rico) - In recognition of services rendered to the profession, achievements in engineering education and his performance as Vice-President of the Puerto Rico Electric Power Authority Board of Directors.
- Recipient "2010 Distinguished UPRM Alumni" from the University of Puerto Rico Mayagüez Alumni Association.
- Recipient "Ingeniero Electricista Distinguido 2005" (Distinguished Electrical Engineer 2005) from the Electrical Engineering Institute of the Puerto Rico Professional Engineers Society (Instituto de Ingenieros Electricistas del Colegio de Ingenieros y Agrimensores de Puerto Rico) - In recognition of services rendered to the profession and outstanding professional achievements in the field of electrical engineering.
- Recipient "2004 Professional Progress in Engineering Award" (PPEA) from Iowa State University

PROFESSIONAL PROGRESS IN ENGINEERING AWARD - Established in 1988

In recognition of outstanding professional progress and personal development in a field of engineering specialization as evidenced by significant contributions to the theory and practice of engineering, distinguished service rendered to the profession, appropriate community service, and/or achievement in a leadership position. There shall also be evidence of recognition through citations and acceptance of achievements by colleagues, and of the promise of continued progress and development.

- Recipient "2003-2004 Electrical and Computer Engineering Outstanding Faculty Award" from the School of Engineering, Mayagüez, Puerto Rico
- Recipient "Iowa State University Research Excellence Award" for Ph.D. dissertation
- Registered Professional Electrical Engineer in Puerto Rico (6/91) and Member of the "Colegio de Ingenieros y Agrimensores de Puerto Rico"
- Magna Cum Laude – BSEE, University of Puerto Rico, 1988
- Member Institute of Electrical and Electronic Engineers (IEEE) - Power Engineering Society and Faculty Advisor of the Power Engineering Society Student Chapter at the University of Puerto Rico Mayagüez
- Advocate – American Wind Energy Association

- Engineering Futures Facilitator and Member of Tau Beta Pi the National Engineering Honor Society. (06/98 – 06/08) Principal Faculty Advisor of Puerto Rico's Tau Beta Pi Alpha Chapter, (06/08 - present) Faculty Advisor of Puerto Rico's Tau Beta Pi Alpha Chapter

SERVICES RENDERED TO THE PROFESSION

- Member of the Energy Committee of the Puerto Rico Engineers and Surveyors Association (CIAPR, from the Spanish "Colegio de Ingenieros y Agrimensores de Puerto Rico").
- Member of the AD HOC Committee for Renewable Energy and Climate of the Puerto Rico Engineers and Surveyors Association (CIAPR, from the Spanish "Colegio de Ingenieros y Agrimensores de Puerto Rico").
- Instructor of Continuous Education Courses at the Puerto Rico Engineers and Surveyors Association (CIAPR, from the Spanish "Colegio de Ingenieros y Agrimensores de Puerto Rico")
- Member of the AD HOC Committee to Evaluate the Technical Administration of the Puerto Rico Electric System by the Puerto Rico Electric Power Authority during the Tropical Storm (TS) Jeanne of September 15, 2004 - The official state inquiry by the CIAPR into what caused a general electric blackout in the Island of Puerto Rico during Tropical Storm Jeanne. It is part of the CIAPR public responsibility to conduct such inquiries when technical matters are in dispute. Responsibilities included: analysis of technical evidence, as submitted by PREPA, of the power system state and behavior as TS Jeanne crossed over Puerto Rico, the formulation of a hypothesis to explain such behavior, and to judge the decisions made on the administration of the power system during the storm.

EXAMPLES OF UNDER GRADUATE RESEARCH and DESIGN PROJECTS:

1. **Design of the Distribution System for an Eolic Generation Park.** The complete design of the Distribution System for an Eolic Generation Park. This included the decision to install an aerial or underground system and specification of: transformers, conductors, protection system, grounding system, conduits, junction boxes, lighting protection and design of the substation to connect the eolic park with the local electric utility. Other requirements included: estimate of materials and construction costs, a construction and project management schedule and analysis to determine the required reactive compensation. Students: Franchesca Aponte Santiago, Dumeng Roman Johana, Melissa Hernandez Bernier, Erika Padilla Ocasio, Magaby Quintero Lopez, Marilyn Ramirez Alvarado, Sharlene Rivera Gonzalez, Rodolfo Morales Medina and Giancarlo Santos Santiago.
2. **Environmental and infrastructure impact of eolic generation in Puerto Rico.** The study of key aspects of eolic generation and their environmental impact with emphasis in: noise, electromagnetic interference, avian issues and aesthetic considerations. Student studied the infrastructure impact of eolic generation projects specifically on roads, sea ports and sea bottom. Students were aware of socio-economic and political considerations and implications on eolic generation projects. Students: Camille T. Ocasio, Verónica Narváez and David Marrero.
3. **Design Projects in Power Electronics: Design, Simulation, Fabrication and Test of Brushless Commutator for Permanent Magnets DC Motors.** Project involved the preliminary design of a brushless commutator including computer simulations of the proposed circuit, identification of components to be used including component costs and manufacturer data, necessary tools and materials needed to construct and test the commutator, and detailed work schedule of the steps needed to complete the design and prototype construction tasks. A working prototype and documented results of tests performed to the prototype to ensure its compliance with design

specifications was required. Proposed modifications to solve any problems found during testing, computer simulations of the proposed modifications to the commutator circuit were also required. Students: Noel G. Figueroa Urdaz, Camille Guzmán Torres, Lourdes Orona Jiménez, José J. Rodríguez Alvarez, Reyes M. Ruiz Donate, José L. Valenzuela Rivera and Miguel D. Vázquez Peña.

4. **Development of an Animated One-line Equivalent of Puerto Rico's Existing Electric Power System.** Project involved the use of the commercially available **PowerWorld Simulator**, a user-friendly, highly interactive package for engineering analysis, to develop a one-line equivalent of Puerto Rico's existing electric power system. The animated and graphical one-line equivalent of Puerto Rico's electric system is geographically accurate as well as electrically equivalent to the generation and transmission (115 kV and above) of the Puerto Rico Electric Power Authority (PREPA). This equivalent has been used by engineering students to study the behavior of Puerto Rico's electric power grid under a variety of system conditions. It will also provide an excellent teaching tool to demonstrate the principles of electric power flow, voltage profiles and their relation to reactive power, economic dispatch and steady-state system security. Students: Ivette Malpica
5. **Using Virtual Worlds to Explore Electric Power Grids and Plants.** Virtual worlds provide the capability of visiting spaces difficult to explore because of: time constraints, natural hazards, and cost of accessibility or access restrictions. Electric power system courses are constrained to show primary components of a power system using drawings and photos. Development of virtual worlds tailored to suit the topic being discussed is an attractive solution. Student may browse around the system learning as they go along. They provide motivation and the electric utility may use these tools to familiarize new personnel with their system and inform and educate non-technically trained decision-makers using accurate and visually attractive presentations. Two undergraduate students participated in the project developing virtual worlds of a power plant. Students: Iomar Vargas and Emmanuel Arzuaga.

OTHER PROFESSIONAL EXPERIENCE

- (2006) Implementation Specialist – Alliance for the Strengthening of Mathematics and Science Teaching (AFAMaC): An Alliance among the Puerto Rico Department of Education and University of Puerto Rico Mayagüez (UPRM) to professionally advance Mathematics and Science school teachers of 7th, 8th and 9th grade in three Educational Districts; Mayagüez, Moca and San Sebastian. The primary goal of the project is to improve knowledge and practice of Mathematics and Science teachers through summer and weekend long internships at the UPRM taking courses that will focus on content (Math, Physics, Chemistry, Geology, Basic Engineering, and Information Technology) rather than teaching methods.
- (01/03) Consultant – Engineering evaluation of electrical installation at a private residence in Mayagüez, Puerto Rico. Identified electrical design deficiencies and failures to comply with the National Electric Code.
- (05/98 – 08/98) Consultant – Electric Energy Audit and Consumption Estimates for a small Hotel in Aguadilla, Puerto Rico. Analyzed electric bills and estimated energy consumption of the Hotel including internal generation to settle a billing dispute between the Hotel Management and the Puerto Rico Electric Power Authority.
- (02/98 – 04/98) Consultant – Redesign the electric distribution system of a Trailer Camp Facility in La Parguera, Puerto Rico.
- (1/94 - 5/96) Computer Network System Administrator at Iowa State University, Ames, Iowa
Performed software and hardware system administration for UNIX workstation network serving 50

users.

- (7/93 - 10/96) Research Assistant at Iowa State University, Ames, Iowa
 - Developed a risk-based method to assess security and determine operating limits for electric power systems, a project sponsored by Electric Power Research Institute (EPRI).
 - Utilized state of the art industry-grade power systems software applications (power flow, stability, etc).
 - Performed large scale system studies of WSCC network
 - Supervised two undergraduate students in their undergraduate research projects

- (8/90 - 6/93) Assistant Researcher at the University of Puerto Rico, Mayagüez, Puerto Rico

Administered the optics and laser facilities of the Physics Department and supervised authorized personnel in the operation of the equipment

- (9/89 - 2/90) Research Assistant at the University of Michigan, Ann Arbor, Michigan

Developed a novel and simple technique to create an optical source capable of providing high peak power at a desired frequency or a short pulse with a tunable, spectrally pure frequency

- Summer Intern at Aluminum Company of America, ALCOA Center, Pennsylvania
 - (5/90 - 7/90) Characterized electromagnetic field properties of electromagnetic acoustic transducers and eddy current sensors
 - (5/89 - 8/89) Implemented the Digital Holographic Interferometry Technique for surface displacement measurements
 - (6/88 - 8/88) Implemented the Synthetic Aperture Focusing Technique for ultrasonic testing using an HP1000 computer
 - (6/87 - 8/87) Designed, fabricated and analyzed electromagnetic acoustic transducers

ADDITIONAL EDUCATIONAL INFORMATION:

Graduate Coursework:

23 hours in Power Systems, 23 hours in optics, 12 hours in electromagnetics, 9 hours in Control Systems, 12 hours in Math and 9 hours in probability and statistics.

Salient Ph.D. Research Contributions:

- Developed a method that allows risk-based security assessment in an operating environment considering any type of security violation.
- Developed, using probability theory, expressions to calculate the conditional probability of insecurity given a fault occurs for thermal overloads and transient instability.
- Developed a method to generate risk-based operating limits in terms of parameters available to system operators, illustrated using nomograms based on risk rather than deterministic limits. The change from deterministic to risk-based operating limits is transparent to system operators since they just see new nomograms or tables.
- Investigated the effect of conventional protection systems on risk of an operating point.

Participated in investigation of the effect of special protection schemes on risk of transient instability.

Daniel Gutman
407 West 44th Street
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212 586-3888

Education:

Massachusetts Institute of Technology
Cambridge, Massachusetts

B.S., Physics
June, 1964

University of Illinois
Urbana, Illinois

M.S., Physics
February, 1966

Summary of Consulting Experience:

Environmental Protection Agency

Chief analyst for the United States Environmental Protection Agency on traffic and environmental impacts of Westway, a highway proposed for Manhattan. Responsible for preparing cross-examination of State Department of Transportation witnesses and for developing and presenting EPA's direct testimony during administrative hearings.

Environmental Defense Fund
Scenic Hudson

Analyzed the local impact of increased sulfur dioxide emissions due to the proposed conversion to high sulfur coal of Orange and Rockland's Lovett and Danskammer, and the conversion to coal of Con Edison's Arthur Kill and Ravenswood power plants for presentation at administrative hearings.

The Municipal Art Society
STAND
The ATURA Coalition
Committee to Preserve Brighton Beach and
Manhattan Beach

Conducted traffic and air pollution analyses of several major development projects in New York City, including the Coliseum Redevelopment, Metrotech, Atlantic Terminal, and Brighton Beach projects.

Union of Concerned Scientists

Analyzed the potential for accidental releases of radioactive gases reaching New York City from the nearby Indian Point nuclear reactor.

Environmental Defense Fund
Natural Resources Defense Council

Provided technical analysis and evaluations of EPA regulations concerning all sulfur dioxide emitting facilities, as well as those specifically applying to copper smelters.

Association to Save the Hutch
Montgomery Township, New Jersey
Elizabeth and East Brunswick, New Jersey

Provided analyses of the air pollution and traffic impacts of the proposed expansions of the Hutchinson River Parkway, Route US 206 through Montgomery Township, and the New Jersey Turnpike.

Port Authority of New York and New Jersey

Evaluated the impacts of diesel particulates and carbon monoxide due to a proposed busway connecting the Holland and Lincoln tunnels just outside New York City.

Environmental Defense Fund

Investigated the environmental impacts of both toxic and non-toxic emissions from waste-to-energy resource recovery plant proposed for New York City for presentation at administrative hearing.

Citizens for Westpride

Analyzed traffic, air pollution, noise, sewage disposal, and zoning and density with respect to both a massive development proposed by the Trump Organization for a disused rail yard on the West Side of Manhattan, and a number of other projects in the immediate area.

The Parks Council
The Municipal Art Society
The Regional Plan Association

Devised a smaller-scale, more civic-minded alternative to the Trump project, based on relocating a portion of the West Side Highway in order to extend Riverside Park. Evaluated the air pollution and noise impacts of the relocated West Side Highway and investigated various noise control techniques. Known as Riverside South, this alternative was ultimately embraced by the developer and approved by the City.

The Municipal Art Society
Beekman Hill Association

Studied potential air pollution impacts of Con Edison's Waterside power plant in New York City on a proposed very tall, nearby building.

Environmental Defense
New York Lawyers for the Public Interest

Analyzed air quality impacts of diesel emissions from a proposed waste transfer station on nearby residential areas as part of an administrative hearing. Developed legal and technical arguments to require an air quality analysis of fine particulate matter (PM 2.5).

East River Environmental Coalition
Manhattan Community Board #3

In connection with an application by Con Edison to add two electric and steam generators to the East River power plant, analyzed air quality impacts, focussing on fine particulate matter, evaluated noise impacts, helped develop alternative proposals, analyzed the air quality and land-use impacts of the alternatives, and represented client groups in administrative hearings.

Natural Resources Defense Council
Coalition Helping Organize a Kleaner Environment
Borough President of Queens, New York

In connection with applications by Keyspan, SCS Astoria, Orion Power, and the New York Power Authority to add power plants in the Astoria section of New York City, analyzed air quality impacts, focussing on fine particulate matter, analyzed the air quality impacts of the alternatives, and represented client groups in administrative hearings.

Adirondack Communities Advisory League

Presented testimony in administrative hearings regarding impacts of toxic air emissions from a proposed landfill in Ava, New York.

Greenpoint/Williamsburg Waterfront Task Force
Borough President of Brooklyn, New York

In connection with an application by TransGas Energy to add power plants in the Greenpoint/Williamsburg section of New York City, analyzed air quality impacts, focussing on fine particulate matter, analyzed the air quality impacts of the alternatives, and represented client groups in administrative hearings.

Hell's Kitchen Neighborhood Association

Prepared a major zoning and land use plan for the West Side of Manhattan between 30th and 42nd streets as an alternative to City-sponsored plan.

Participation in Judicial, Administrative, and Legislative Proceedings of Environmental Organizations:

1. Comité Diálogo Ambiental:

- a. Judicial proceedings:
 - i. Comité Diálogo Ambiental v. Autoridad de Desperdicios Sólidos, KLRA1997-00795. Subject: Administrative Agency Review.
 - ii. Comité Diálogo Ambiental v. Junta de Calidad Ambiental, KLRA2006-00885. Subject: Administrative Agency Review.
 - iii. Comité Diálogo Ambiental v. Junta de Planificación de Puerto Rico, KLRA2008-01318. Subject: Administrative Agency Review.
 - iv. Comité Diálogo Ambiental v. Oficina de Gerencia de Permisos (OGPE), KLRA2016-00167. Subject: Administrative Agency Review.
 - v. Comité Diálogo Ambiental v. Junta de Planificación de Puerto Rico, KLRA2016-00034. Subject: Administrative Agency Review.
 - vi. Utility Solid Waste Activities Group v. Environmental Protection Agency v. Waterkeeper Alliance et al., USCA Case No. 15-1219 (2018), 2016 WL 2941535 (C.A.D.C.). Subject: Petition for Review of Final Administrative Actions. Intervenors.
 - vii. Comité Diálogo Ambiental, Inc. v. Fed. Energy Regulatory Comm'n, No. 16-1229, 2019 WL 2149704 (D.C. Cir. May 14, 2019).
- b. Administrative proceedings:
 - i. Aguirre Offshore Gasport, LLC, 166 FERC ¶ 61055 (Jan. 28, 2019). Intervenors.
 - ii. Aguirre Offshore Gasport, LLC, 155 FERC ¶ 61139 (May 5, 2016). Intervenors.
 - iii. Aguirre Offshore Gasport, LLC, 152 FERC ¶ 61071 (July 24, 2015). Intervenors.
 - iv. Comments by Comité Diálogo Ambiental to the Proposed Amendments to National Minimum Criteria (Phase One) Disposal of Coal Combustion Residuals from Electric Utilities, Docket ID No. EPA-HQ-OLEM-2017-0286 (2018).
 - v. In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors. Public Comments.
 - vi. Comments on the Proposed “Standards for the beneficial use of coal combustion waste” at Puerto Rico Department of Natural and Environmental Resources, 2019.

2. El Puente de Williamsburg, Inc. Enlace de Acción Climática:

- a. Administrative proceedings:
 - i. In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors. Public Comments.

3. Sierra Club Puerto Rico

- a. Judicial proceedings:
 - i. Sierra Club v. United States Fish and Wildlife Service, United States Department of Interior, Secretary Kenneth Salazar, in his official capacity, Acting Director Rowan Gould, in his official capacity, Defendants., 2011 WL 2098216 (D.D.C.). Subject: Administrative Agency Review.
 - ii. Sierra Club de Puerto Rico, Ciudadanos en Defensa Del Ambiente, Madres de Negro de Arecibo, and Comité Basura Cero Arecibo, Petitioners, v. U.S. Environmental Protection Agency and Gina McCarthy in her official capacity as Administrator of the U.S. Environmental Protection Agency, Respondents, Energy Answers Arecibo, LLC, Intervenor-Respondents., 2015 WL 5081701 (C.A.D.C.). Subject: Petition for Review of a Final Rule of the EPA.
- b. Administrative proceedings:
 - i. In re: Investigación de la Comisión de Energía en Torno al Estado del Sistema Eléctrico de Puerto Rico luego del Paso del Huracán María, CEPR-IN-2017-0002. Public Comments.
 - ii. In Re: Reglamento sobre el Desarrollo de Microredes, CEPR-MI-2018-0001. Public Comments.
 - iii. Comments on the Proposed “Standards for the beneficial use of coal combustion waste” at Puerto Rico Department of Natural and Environmental Resources, 2019.
 - iv. In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors. Public Comments.

4. Amigos del Río Guaynabo

- a. Administrative proceedings:
 - i. In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors. Public Comments.

5. Coalición de Organizaciones Anti Incineración

- a. Judicial proceedings:
 - i. ADS v. CEEDA, Inc., 2014TA2442
 - ii. Bey Nazario v. Junta de Calidad Ambiental, 2015TA330
 - iii. Biaggi Caballero v. Junta de Calidad Ambiental, 2015TA4568
 - iv. Bey Nazario v. Junta De Planificación, No. 2010-06-0231-JPU, 2015 WL 10438673 (P.R. Cir. Jan. 22, 2015). Subject: Administrative Agency Review.
 - v. Energy Answer Arecibo LLC v. Depto. de Recursos Naturales y Ambientales, 2017TA1070, KLRA2016-00319, KLAN2015-00975.
 - vi. In Re: Energy Answers Arecibo, LLC, 2017TA1565, KLRA2017-00142.

- vii. Bey Nazario v. Junta de Planificación, 2016TA77.
- viii. Energy Answers Arecibo, LLC v. Conty Hernández, 2019TA405, KLAN2018-01372.

b. Administrative proceedings:

- i. In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors. Public Comments.
- ii.

6. Comité Yabucoeño Pro-Calidad de Vida

a. Administrative proceedings:

- i. Participation in public hearing before the Environmental Quality Board about Air Permit Exemption to Sun Oil (1988).
- ii. Construction Permit Consultation for Yabucoa Solar, LLC, Case No. 2012-PCO-00109. Intervenors. Solar Farm Project in Yabucoa Agriculture Reserve.
- iii. Building site Permit, Case No. 2014-75-0121-JGU-T. Intervenors. Solar Farm in La Lucía Nature Reserve.
- iv. In Re: Opposition to the Granting of permission to Caribbean Buckeye Terminal, LLC, Yabucoa, P.R., US Environmental Protection Agency, TV-4226-77-0397-0025 PFE (2016).
- v. In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors. Public Comments.

b. Legislative proceedings:

- i. Public hearing participation before the Senate and House of Representatives in RC 173, RS 1158, PS 81, PS 123, PS 128.

7. Alianza Comunitaria Ambientalista del Sureste

a. Administrative proceedings:

- i. Comments on the Proposed “Standards for the beneficial use of coal combustion waste” at Puerto Rico Department of Natural and Environmental Resources, 2019.
- ii. In Re: Review of the Puerto Rico Electric Power Authority Integrated Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors. Public Comments.

8. Mayagüezanos por la Salud y el Ambiente

a. Judicial proceedings:

- i. Cogentrix of Mayaguez, Inc. v. Mayagüezanos por la Salud y el Ambiente, I PE1993-0063. Subject: Injunction - Disturbance and Impairment
- ii. Mayagüezanos por la Salud y el Ambiente v. Junta de Planificación de Puerto Rico, KLRA2001-00039. Subject: Administrative Review

- iii. Mayagüezanos por la Salud y el Ambiente v. Junta de Calidad Ambiental,
K PE1991-1068. Subject: Injunction
- b. Administrative proceedings:
 - i. In Re: Review of the Puerto Rico Electric Power Authority Integrated
Resource Plan, Case No. CEPR-AP-2018-001. Potential Intervenors.
Public Comments.

Congress of the United States

Washington, DC 20515

June 13, 2019

The Honorable Thomas Rivera Schatz
President
Senate of Puerto Rico
El Capitolio, Senado
PO Box 9023431
San Juan, P.R. 00902-3431

Dear President Rivera Schatz:

We write to urge you to join us in opposing the Restructuring Support Agreement (RSA) reached on May 3, 2019 between the Puerto Rico Electric Power Authority ("PREPA"), the Puerto Rico Fiscal Agency and Financial Advisory Authority ("AAFAF"), the Financial Oversight and Management Board for Puerto Rico ("FOMB"), the Ad Hoc Group of PREPA Bondholders, and Assured Guaranty Corp. for the restructuring of \$8 billion of legacy debt issued by PREPA. In addition, we respectfully request that you defend the implementation of the affordability and renewable energy goals included in the Puerto Rico Energy Public Policy Act of 2019.

National and local policy experts agree that the new PREPA RSA is excessively generous to creditors.¹ First, while fiscal policy experts recommend reducing Puerto Rico's overall debt by approximately 80 percent,² the RSA generates a reduction in the principal of the existing PREPA bonds of only 22.5 percent.³ Second, the legacy debt charge that will be added to the amount billed to PREPA's customers will be higher under the new RSA than under the RSA dated July 30, 2018.⁴ It is unacceptable that after 10 months of additional negotiations to reach a sustainable debt restructuring agreement for PREPA, the residents of Puerto Rico end up with an insufficient reduction in principal and paying higher legacy debt charges in their monthly electricity bill.

¹ Cathy Kunkel & Tom Sanzillo, *Under PREPA's new debt deal, electricity prices will rise 13% by next summer in Puerto Rico*, INSTITUTE FOR ENERGY ECONOMICS AND FINANCIAL ANALYSIS (May 7, 2019), <http://ieefa.org/ieefa-update-under-prepas-new-debt-deal-electricity-prices-will-rise-13-by-next-summer-in-puerto-rico/>.

² Martin M. Guzman & Joseph E. Stiglitz, *An Analysis of Puerto Rico's Debt Relief Needs to Restore Debt Sustainability*, NATIONAL BUREAU OF ECONOMIC RESEARCH (Nov. 2018), <https://www.nber.org/papers/w25256>.

³ Sergio M. Marxuach, *PREPA Debt Restructuring 3.0: It is Even Worse Than You Think*, CENTER FOR A NEW ECONOMY (May 2019), <http://grupocne.org/wp-content/uploads/2019/05/PREPA-Debt-Restructuring-3.0-FINAL.pdf>.

⁴ *Id.*

Moreover, the new RSA conflicts with the Puerto Rico Energy Public Policy Act. The law - passed by the current members of the Puerto Rico legislature and signed into law by Gov. Ricardo Rosselló - establishes that:

The energy public policy has the mission to achieve the following initial objectives:

(...)

16) Establish the necessary elements to achieve the People of Puerto Rico's aspiration to have a new Electric System with **rates lower than 20 c/kWh**, and clean, modern, and reliable energy that serves as a foundation for the **sustainable economic development of the Island**.⁵ (emphasis added)

PREPA's customers pay approximately 22 c/kWh and the legacy debt charges in the new RSA would increase prices by up to 21 percent.⁶ It is highly unlikely PREPA will be able to completely offset the legacy debt charges included in the new RSA. Contrary to the Puerto Rico Energy Public Policy Act, the new RSA would cause considerably higher electricity rates for decades to come.

The new PREPA RSA also conflicts with Puerto Rico's goal to grow its economy. The Puerto Rico Energy Public Policy Act recognizes that Puerto Rico's future economic growth depends on achieving affordable energy.⁷ Higher electricity rates are detrimental to the local economy, causing businesses to operate with reduced profit margins, leaving them less able to expand and hire new employees. The new RSA will accelerate the outmigration of businesses and residents, depleting what is left of Puerto Rico's economic foundation.

Additionally, the new RSA directly goes against Puerto Rico's new energy policy of moving towards a more decentralized system and the generation of energy using renewable sources. The Puerto Rico Energy Public Policy Act stipulates that the development of microgrids is an essential component for a decentralized and reliable system that incorporates new technologies and sources of renewable energy.⁸ However, the debt restructuring deal requires customers that generate their own electricity to be subject to the legacy debt charge, unless they are completely and permanently disconnected from the electric system.⁹ The new RSA discourages customers to transition to distributed renewable generation.

For the foregoing reasons, we respectfully request that you join us in opposing the new PREPA RSA and defend the implementation of the affordability and renewable energy goals included in the Puerto Rico Energy Public Policy Act.

⁵ Puerto Rico Energy Public Policy Act of 2019.

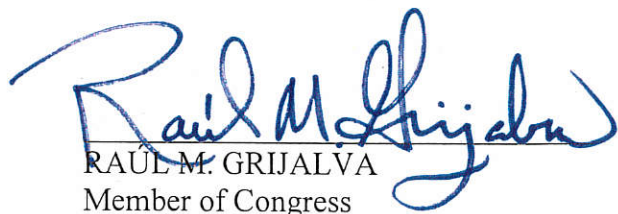
⁶ THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, UNANIMOUS WRITTEN CONSENT APPROVING EXECUTION OF DEFINITIVE RSA OF PREPA (MAY 03, 2019).

⁷ Puerto Rico Energy Public Policy Act of 2019.

⁸ *Id.*

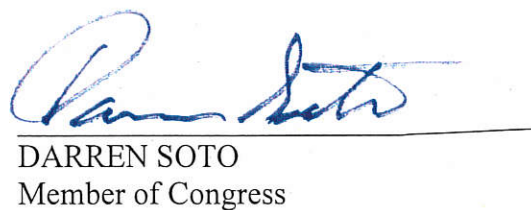
⁹ THE FINANCIAL OVERSIGHT AND MANAGEMENT BOARD FOR PUERTO RICO, UNANIMOUS WRITTEN CONSENT APPROVING EXECUTION OF DEFINITIVE RSA OF PREPA (MAY 03, 2019).

Sincerely,


RAUL M. GRIJALVA
Member of Congress


NYDIA M. VELÁZQUEZ
Member of Congress


ROBERT MENENDEZ
United States Senator


DARREN SOTO
Member of Congress

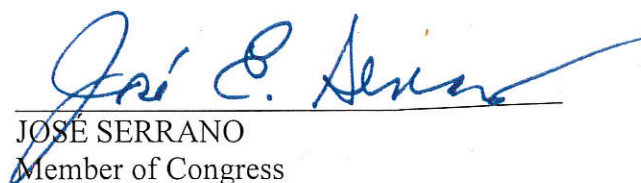

JESUS "CHUY" GARCIA
Member of Congress


JOHN LEWIS
Member of Congress


BERNARD SANDERS
United States Senator

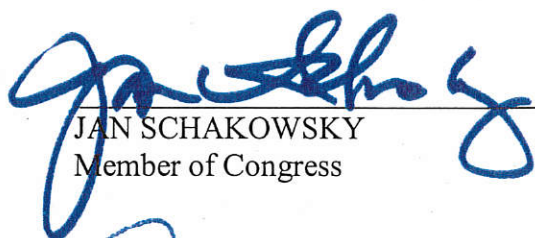

KIRSTEN GILLIBRAND
United States Senator


ADRIANO ESPAILLAT
Member of Congress

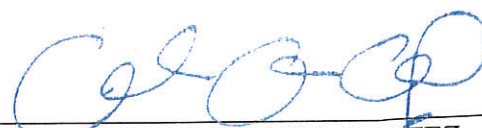

JOSE SERRANO
Member of Congress


BARBARA LEE
Member of Congress

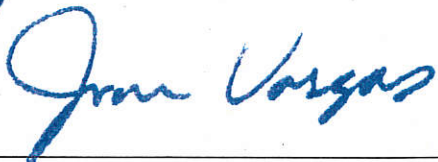

TONY CÁRDENAS
Member of Congress



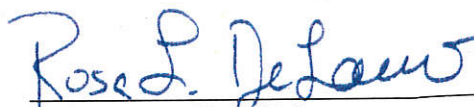
JAN SCHAKOWSKY
Member of Congress



ALEXANDRIA OCASIO-CORTEZ
Member of Congress



JUAN C. VARGAS
Member of Congress



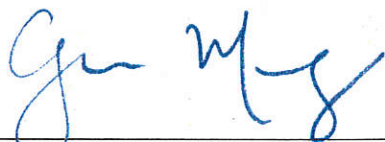
ROSA L. DELAURO
Member of Congress



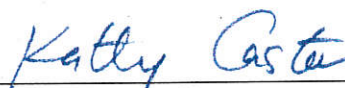
DONALD M. PAYNE, JR.
Member of Congress



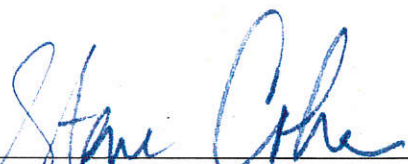
MARK POCAN
Member of Congress



GRACE MENG
Member of Congress



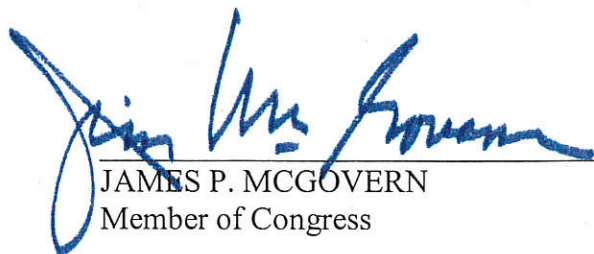
KATHY CASTOR
Member of Congress



STEVE COHEN
Member of Congress



ELIZABETH WARREN
United States Senator




JAMES P. MCGOVERN
Member of Congress



DEB HAALAND
Member of Congress



MARCY KAPTUR
Member of Congress



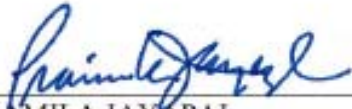
JOHN B. LARSON
Member of Congress



MARK TAKANO
Member of Congress



RUBEN GALLEGO
Member of Congress



PRAMILA JAYAPAL
Member of Congress



ROBIN KELLY
Member of Congress



ALAN LOWENTHAL
Member of Congress



VERONICA ESCOBAR
Member of Congress



TED LIEU
Member of Congress



DAVID CICILLINE
Member of Congress



RO KHANNA
Member of Congress



GREGORY MEEKS
Member of Congress